



High Performance Sustainable Schools

Presenter: Mike Mulheirn



Jefferson County Public Schools is the largest school district in Kentucky and the 26th largest school district in the United States – with more than 97,000 students in 87 elementary schools, 23 middle schools, 20 high schools, and 22 other learning centers.



There are approximately 13,600 full-time employees and 5,800 teachers. The annual budget is approximately \$950 million, with 96 percent of the budget directly funding programs and schools.



JCPS has the 19th largest transportation department in the country – transporting 60,000 students daily, traveling 85,000 miles using 842 buses, making 46,260 stops each day (8 million stops yearly) – traveling enough miles daily to go around the world over three times.



- The JCPS Facility Planning/Construction Department manages over 14.6 million square feet of enclosed building space, including 152 school facilities and 3,723 classrooms. Managing all capital projects for construction, remodeling and renovation of our facilities.



- JCPS received a 2006 ENERGY STAR Award for Isaac Shelby Elementary, one of the first ENERGY STAR schools in Kentucky and the entire southeastern United States region.





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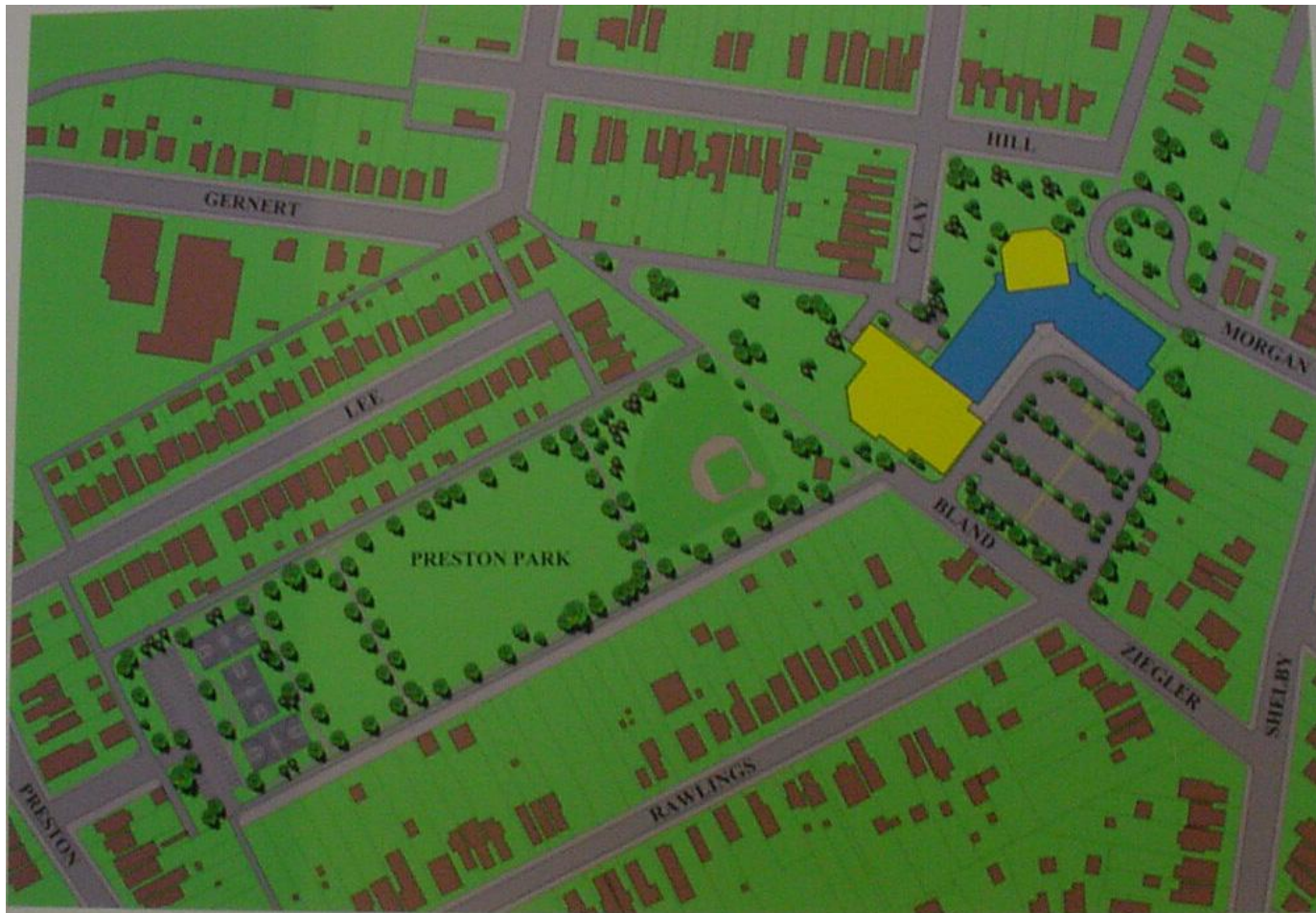
Isaac Shelby at a Glance

- Name: Shelby Elementary (502) 485-8327
- Age: School became occupied January 2004
- Architectural firm(s): Sherman/Carter/Barnhart
- Engineering firm(s): CMTA
- Total Staff: 55
- Total Students: (***600 design load**)
- PC's 210
- Dates of Occupancy: Est. mid August to end of May
- Normal times of Occupancy: 8:00 am to 4:30 pm
- Square Footage: (***83,182 gross building area ft²**)
- Wall Construction: Gypsum board & Metal Studs(inside) Block & Brick(outside)
- Primary type of windows: Thermal heavy duty commercial aluminum
- Building Equipment:
 - 3 Thermal Solution gas Boilers 25.6 H.P. ea
 - 2-125 Trane ton air cooled chillers
 - Fan Powered VAV boxes in occupied spaces
 - 5 Air Handler Units...
 - 2-19,000 VAV/CFM
 - 1-11,000 VAV/CFM
 - 1-11,500 Constant Volume CFM
 - 1-6,500 Constant Volume CFM
- All AHU's have economizers and the outside air system has an **energy recovery wheel** which uses all building exhaust air to precondition outside air that is introduced into the building.
- Typical Start dates for cooling April 15 to October 15
- Typical Start dates for heating October 15 to April 15

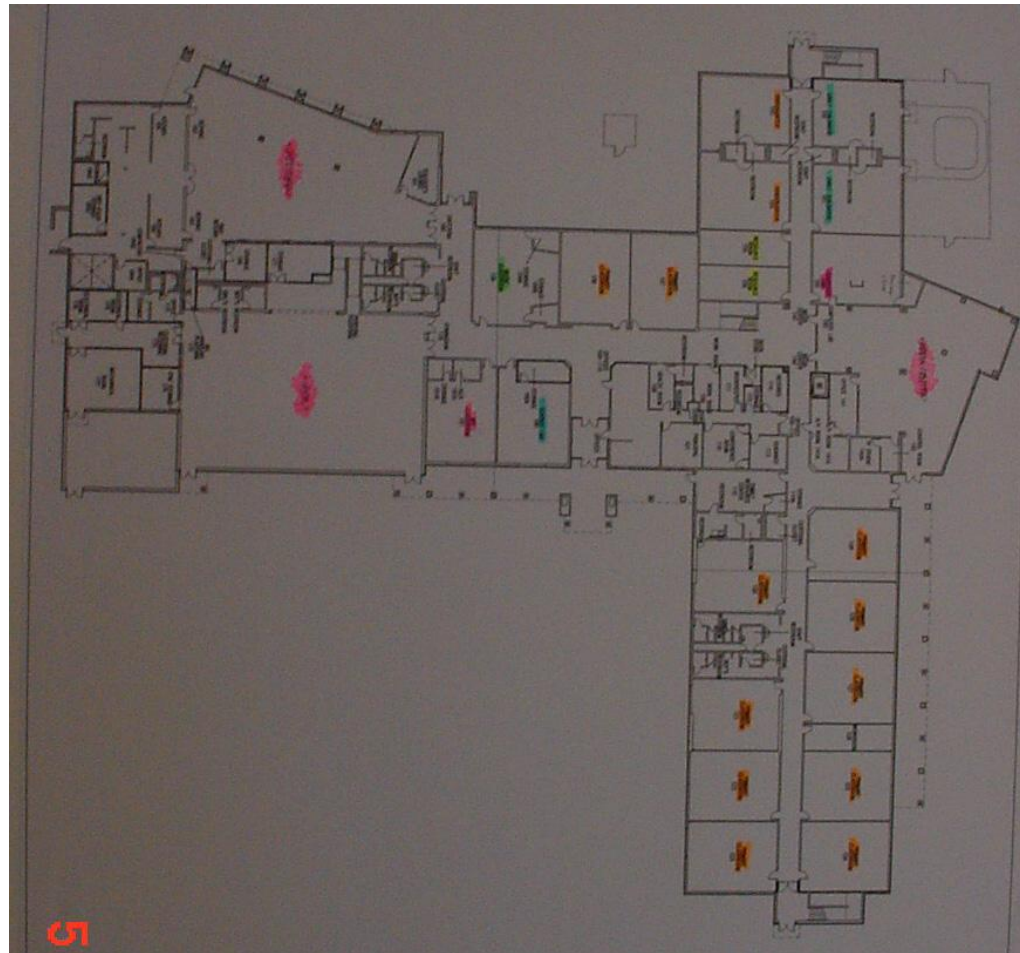
Preconstruction Site Plan



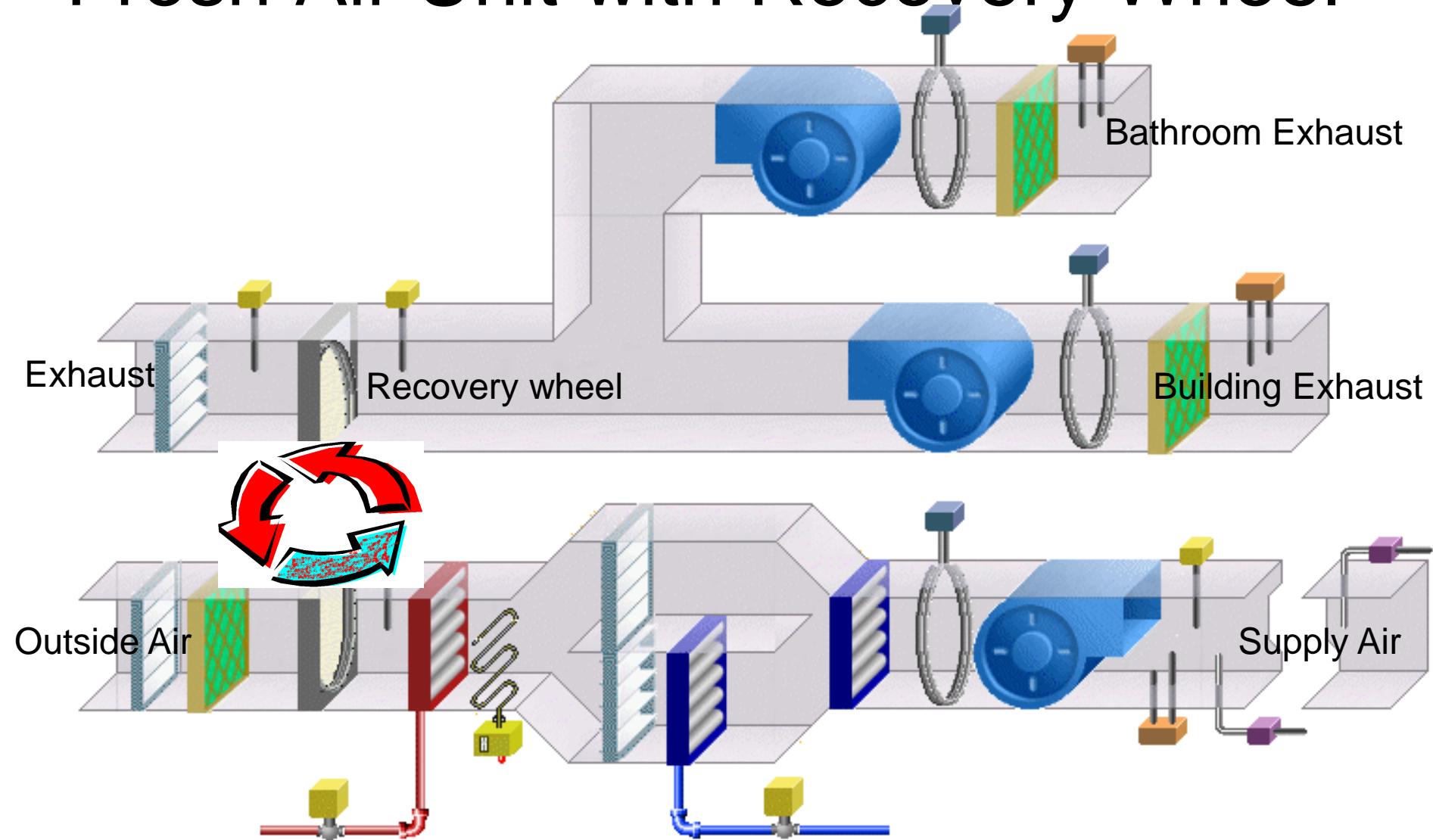
Post Construction Site Plan



Floor Plan



Fresh Air Unit with Recovery Wheel



Issac Shelby Elementary School

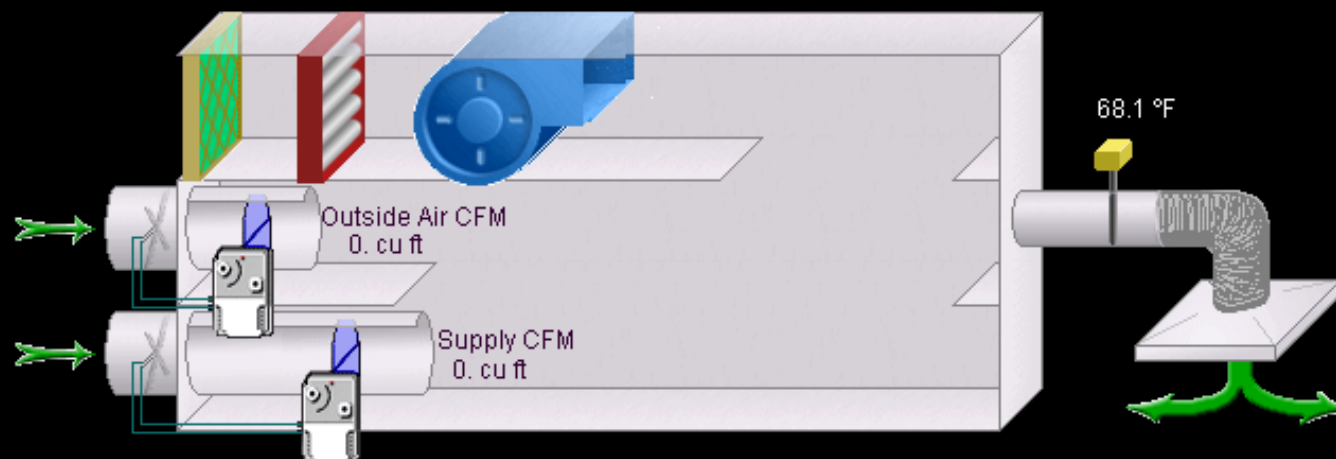
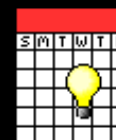
Energy Management System

Room 121

Error

red by

Schedule



VAV Controler

Occupied Status

Occupied

Space Temp 72.9 °F

Supply CFM 0. cu ft

Motion Sensor Occupied

Space Setpoint 73.0 °F

Supply CFM STPT 0. cu ft

Summer/Winter STPT Winter

Supply Air Temp 68.1 °F

OA CFM 0. cu ft

Fan Status Off

OA CFM STPT 0. cu ft

Area Served: Room 121
Instructors Name: Jane Smith
Telephone: 3939
E-mail Address: jsmith@jcps.gov

INFORMATION

Current Time 4:21 PM
Current Date 3/5/07
"Outdoor Temperature" 57.5 °F
"Room Temperature" 72.8 °F
"Discharge Air Temperature" 69.4 °F
"Ventilation Air " Entering 0. cu ft

ADJUSTMENTS

*Right Click on numbers to adjust.

"Thermostat SetPoint" 73.0 °F
*Thermostat Adjustable from 68.0 °F to 73.0 °F
"Number of Occupants" 25 People







Amazing
BUILDINGS

DISTRICT OF COLUMBIA

GET S
GR

Light Shelf and LightLouver™

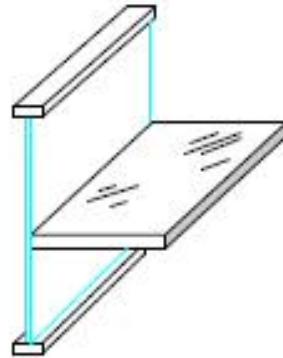


Figure 1. Schematic of Light Shelf.

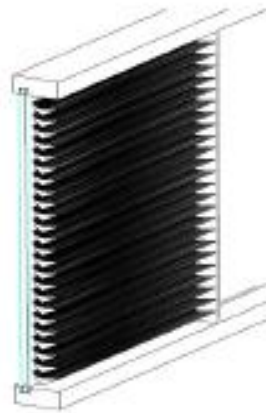


Figure 2. Schematic of LightLouver™ system [13].



Figure 1 –LightLouvers



Figure 3 –16" Light shelf



Figure 2 –24" Light shelf

Results-Clear Midday, Winter

(Arrows show darkness edge on ceiling)

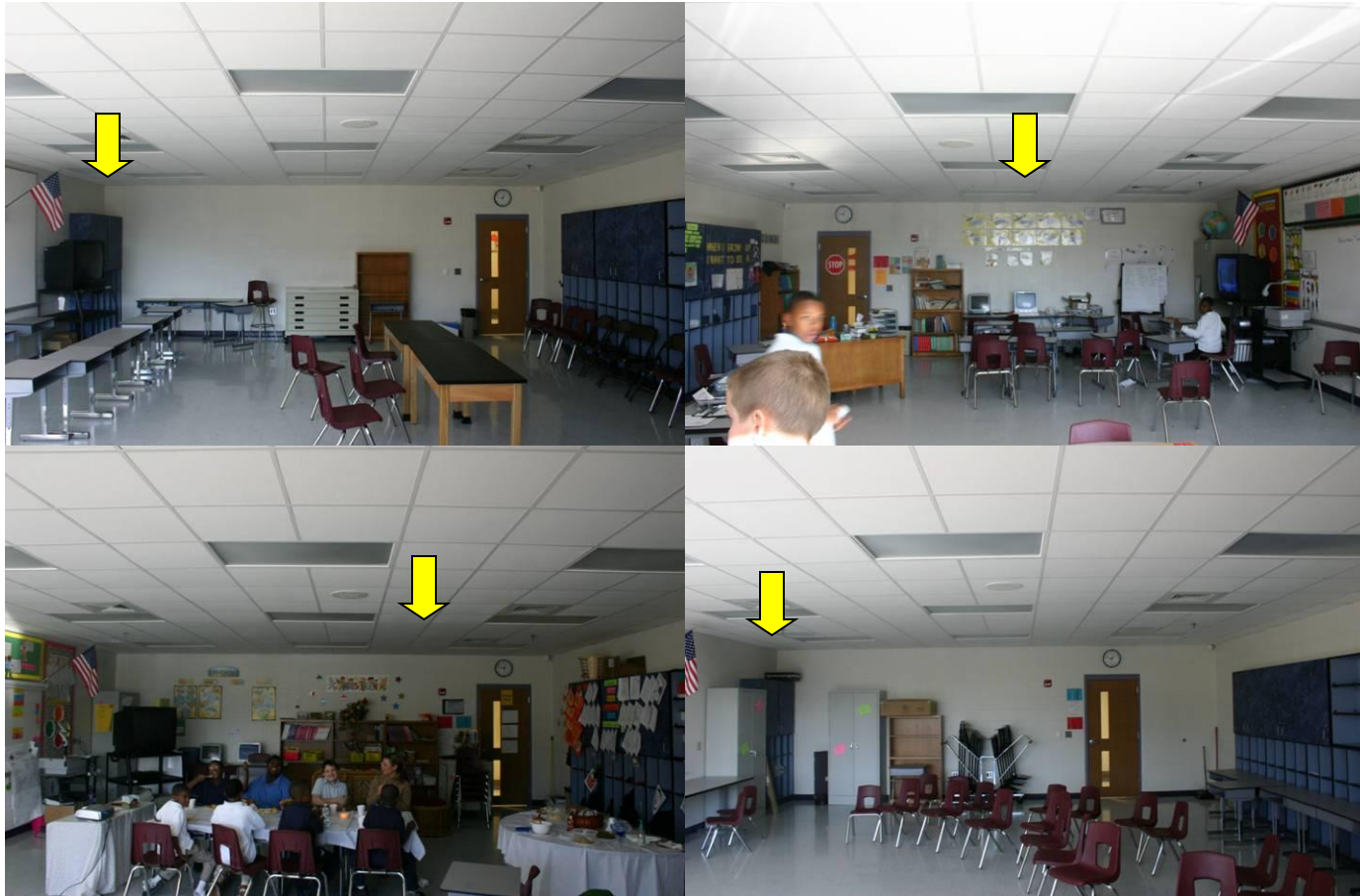


Figure 10 –Classrooms on sunny midday

Results-Cloudy morning, winter

(Arrows show darkness edge on ceiling)



Figure 9 –Classrooms on cloudy morning

Light from Devices

- Light Reflected to ceiling from devices during clear midday, winter



Figure 11 –Light reflected from daylighting devices

- Plots of average of all data sets for each room shown in Figure 7
- Each color band represents 0.5% change in % light available
- Areas in corners with no bands are areas where >10% of light available is present

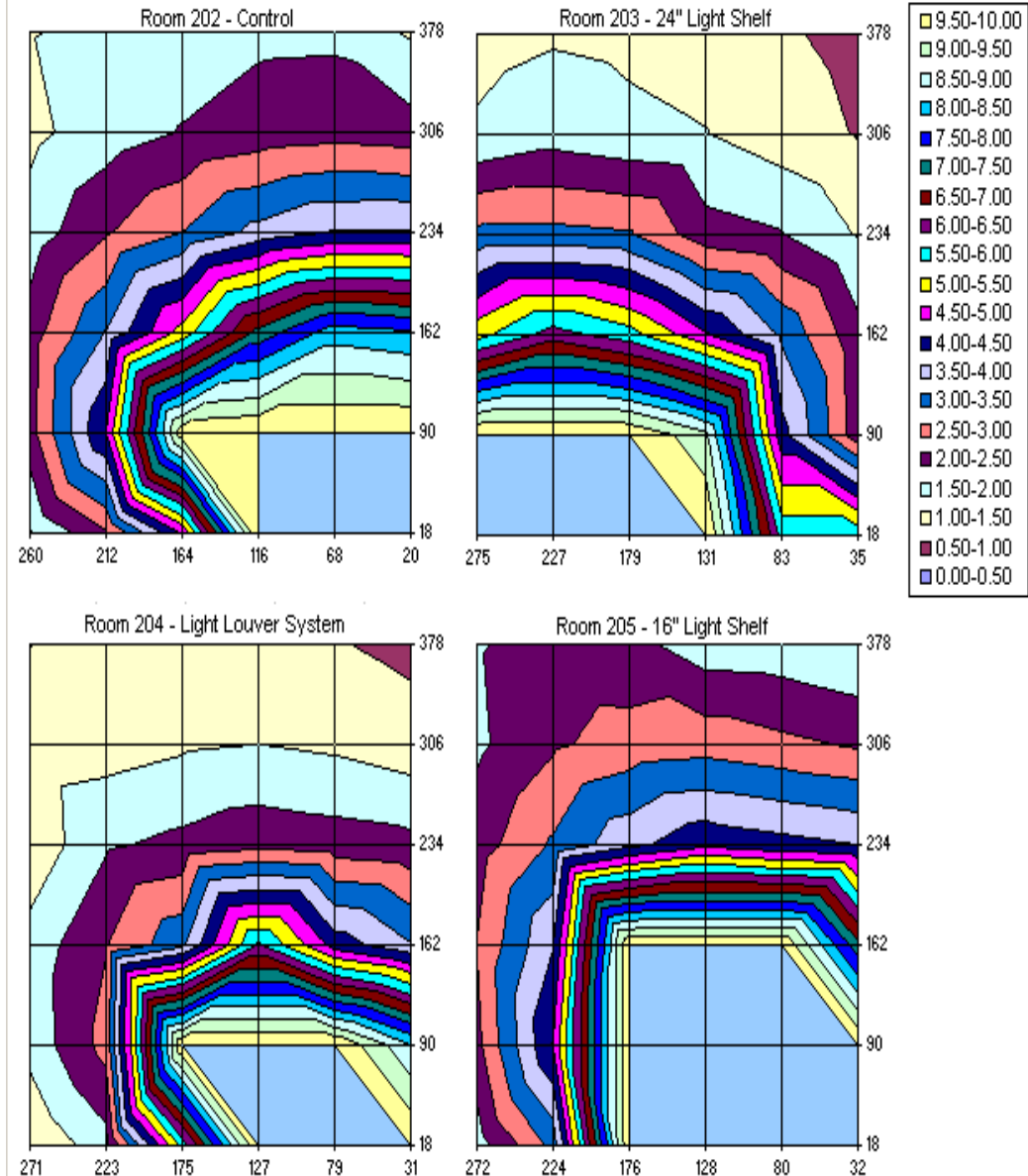


Figure 7 –Average light distribution in rooms

- Plots of % change relative to control room shown in Figure 8
- Areas in bright colors are improvements over control, dark are decreases
- Upper left plot is light distribution in control room
- Dark purple in upper right is greater than 100% increase over control

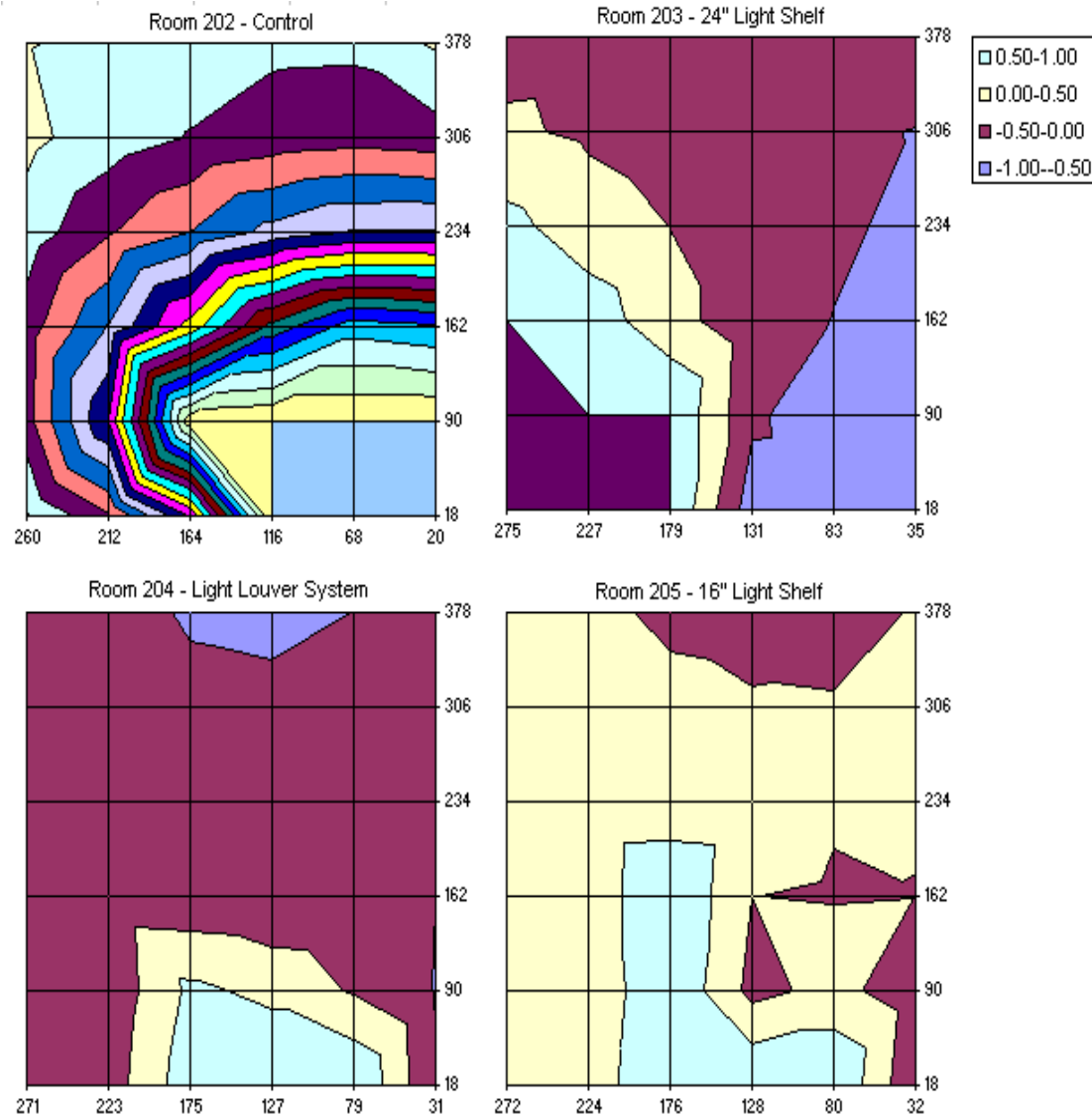
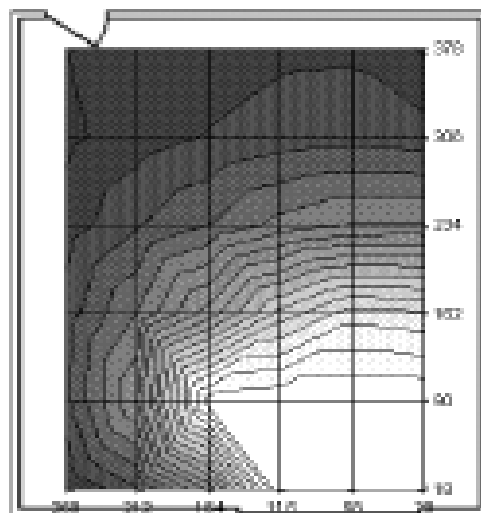
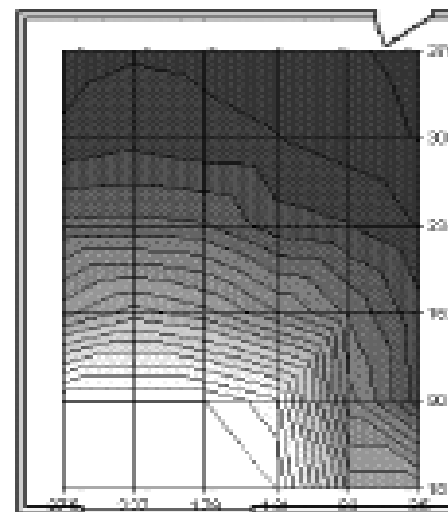


Figure 8 –% Change relative to control classroom

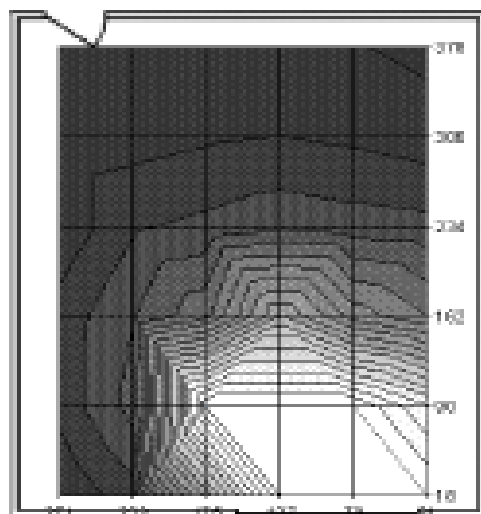
Room 202- Control Room



Room 203- 24" Light Shelf



Room 204- Light covers System



Room 204- 16" Light Shelf

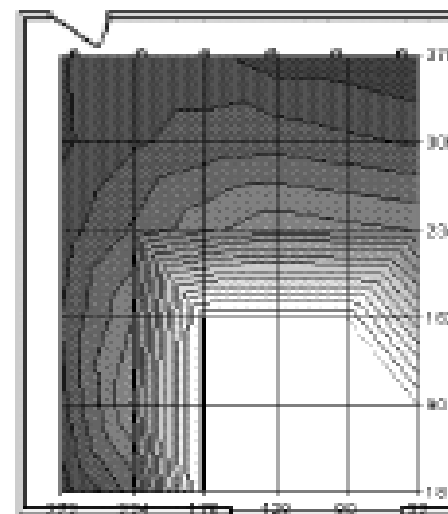


Figure 6 Plots showing average light distribution in classrooms.

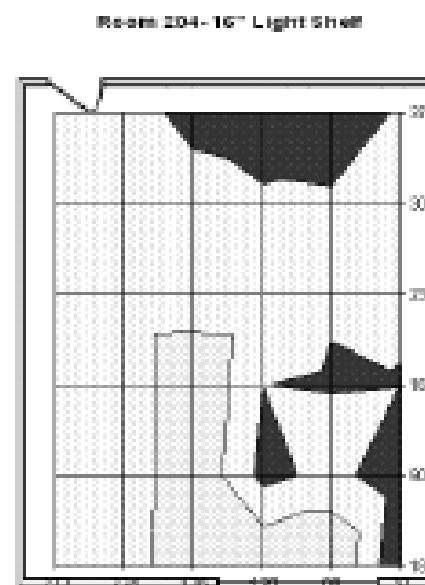
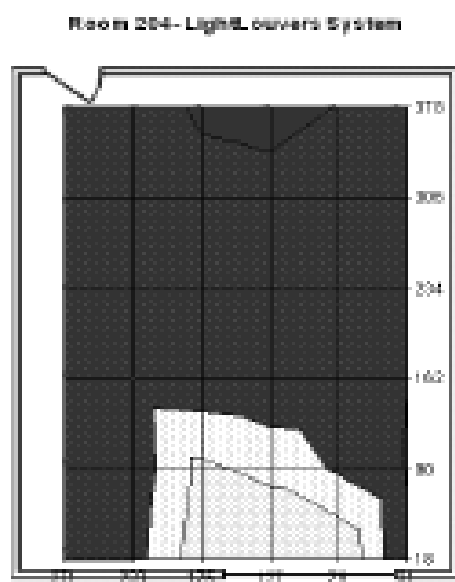
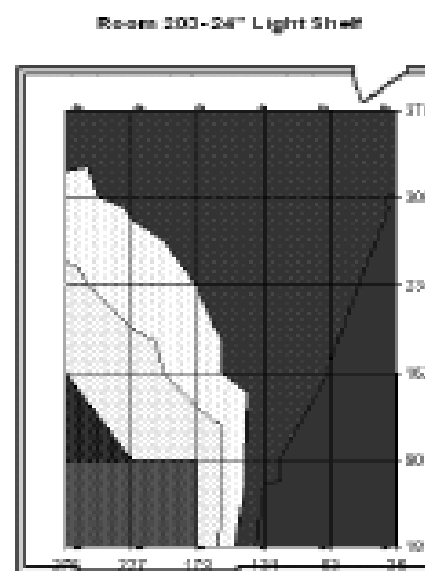
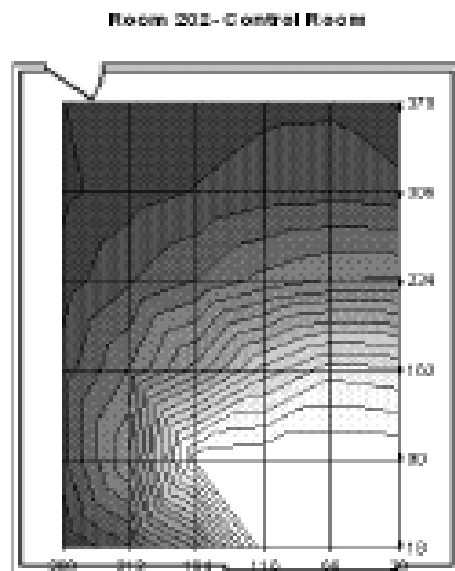


Figure 7. Plots showing light intensity relative to control classroom.

Conclusions-Interpretation of results

- 16" light shelf provides greater performance
 - Only method to provide improvement in light quantity over control room
 - 16" shelf doesn't provide most even results, the 24 " light shelf does this, but window close to east wall may have caused this
- Next best performance is from control room
 - Control room provides performance greater than 24" light shelf and LightLouvers







JCPS Entire District's Energy Use Index 1998 through 2005

Year	Kbtu/Ft ²
1998	<u>72.9</u>
1999	<u>69.9</u>
2000	<u>70.4</u>
2001	<u>71.5</u>
2002	<u>69.7</u>
2003	<u>69.8</u>
2004	<u>68.7</u>
2005	<u>71.7</u>

Energy Information Administration National Average for Educational Facilities **75**

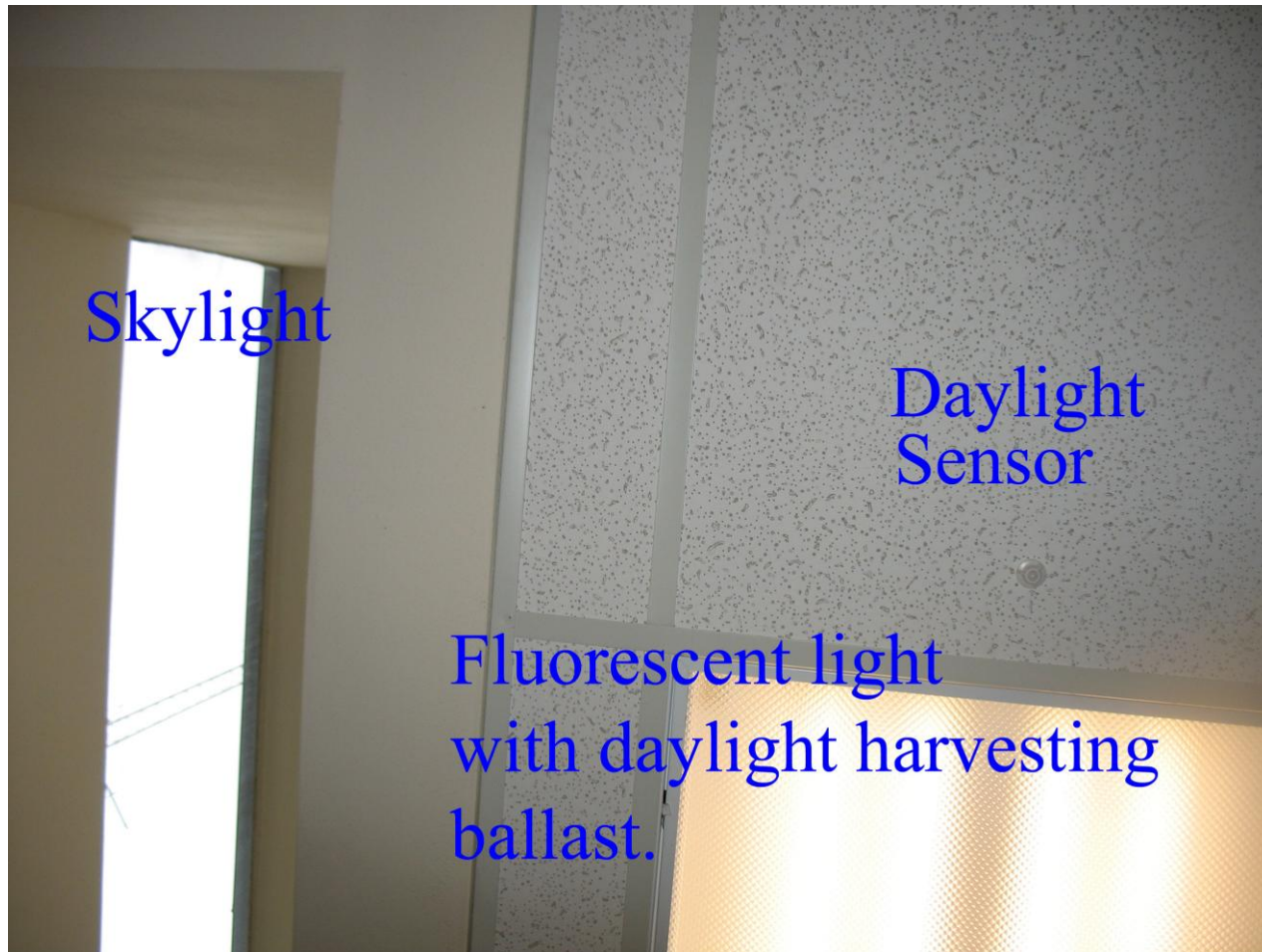
Churchill Park Solar System

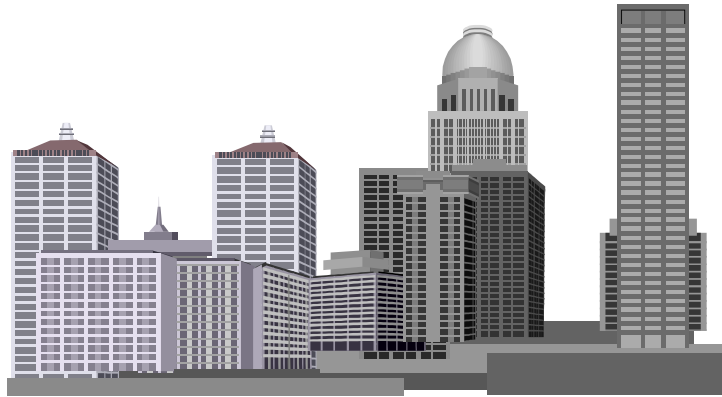


Coleridge Taylor Daylight Harvesting (outside rows have dimming system)



Daylight Harvesting System





Partnership for a Green City – Energy Use Partnership:

In August 2004, Jefferson County Public Schools, Louisville Metro Government and the University of Louisville entered into the Partnership for a Green City, which represents a collaborative effort to improve Louisville's environmental education, environmental health, and processes for waste reduction and energy management by Louisville's three largest public entities.



- The JCPS energy conservation philosophy includes our “*When not in Use, Turn off the Juice,*” stickers above light switches, energy conservation tips in the district Monday Memo newsletter, and systemwide recycling.

- JCPS is proud of our energy initiatives to date, but realize that we are on a never ending journey that will excite and amaze us for many years to come.

